Remarks

The Office Action mailed December 12, 2006, and made final, and the Advisory Action mailed April 4, 2007 have been carefully reviewed and the foregoing amendment has been made in consequence thereof.

Claims 4, 5, 7-12, 16, 17, 19-21, and 25 are now pending in this application. Claims 4, 5, 7-12, 16, 17, 19-21, and 25 stand rejected. Claims 1-3, 6, 13-15, 18, 22-24, and 26 have been canceled without prejudice, waiver, or disclaimer. Claims 4, 5, 7, 16, 17, 20, and 25 have been amended. No new matter has been added.

The rejection of Claims 4, 5, 7, 8, 10-12, 16, 17, 20, 21, and 25 under 35 U.S.C. § 103(a) as being unpatentable over Mattson et al. (U.S. Patent No. 5,229,934) ("Mattson") in view of Snyder et al. (U.S. Patent 5,923,775) ("Snyder"), Labaere et al. (U.S. Patent 5,717,791) ("Labaere") and Toth et al. (U.S. Patent 6,115,487) ("Toth"), and further in view of Florent et al. (U.S. Patent 5,594,845) ("Florent") is respectfully traversed.

Mattson describes an imaging system that includes an examination means (A), an image processing means (B), a bad data identifying means (C), and an image correcting means (D). Examination means (A) collects raw data that is reorganized into data sets by image processing means (B). Image processing means (B) convolves each data set then back projects the image. The bad data identifying means (C) compares the data set to a threshold. A forward projecting means (54) forward projects the data set along each ray of a gradient image representation. The forward projected ray is compared to a standard to determine whether the ray is bad data. The image correcting means (D) includes a pixel averaging means (72) that replaces each bad data pixel with an interpolation derived from adjoining pixels.

Snyder describes a gradient estimation system (70) that processes an input image or signal (60) to generate a gradient image. The gradient image represents a magnitude of a gradient at each point in the image, independent of direction. A threshold segmentation system (80) processes the gradient image to generate a plurality of mask images (100, 110, and 120). A noise measurement system (190) processes the gradient image, the plurality of mask images, and a plurality of scalar

thresholds to generate a plurality of signal dependent noise estimates (230, 240, . . . , 250).

Labaere describes a method of enhancing the contrast of an original image (2) by transforming the image (2) into wavelet maxima. Labaere also describes commonly known techniques of unsharp masking, adaptive histogram equalisation, and a plurality of variants on these generic methods, that all suffer to some extent from a shortcoming that ghost details, called artifacts, are created in a vicinity of significant signal level transitions, which occur, for example, at bone/soft tissue boundaries within an image.

Toth describes a correction algorithm for reducing bone-induced spectral artifacts. An image of a calibration object (BWEQ) and an image of a water or water-equivalent cylinder (WEQ) are acquired. An algorithm evaluates a ratio of images (BWEQ and WEQ) and extracts a region of interest by multiplying the ratio by a function II(r) such that a calibration pattern (CP) is obtained. By subtracting 1.0 from the ratio, and multiplying by a CT number scale factor (ctscale) and an apodizing window (Aw(r)), a calibration error vector (CEV) is obtained that is representative of a circularly symmetric image error introduced by a non-corrected bone-induced artifact. In the algorithm, a combination of various rows of a detector via helical scanning is performed.

Florent describes a means of an image processing method that includes a determination of a common view point for a source image and a target image, and of an orthonormal reference frame having a view point (P) as an origin, and a measurement of a tilting angle, a panning angle, and a scale factor (d) of the target image in the reference frame.

Claim 4 recites a method for facilitating reconstruction of an image, the method including "estimating a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s; generating a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*; and generating an error-candidate projection using the gradient image, wherein to generate the error-candidate projection, said method

further comprises forward projecting the gradient image along β wherein β represents a projection view angle."

None of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a method for facilitating reconstruction of an image as recited in Claim 4. Specifically, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a method that includes estimating a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s. Rather, Mattson describes removing bad data from an image by thresholding a back projected data set, forward projecting the data set, and then comparing the forward-projected data set to a standard to determine if the data set includes bad data. Snyder describes a gradient estimation system that includes a threshold segmentation system that processes the gradient image to generate a plurality of mask images that are used to generate a plurality of signal dependent noise estimates. Labaere describes commonly known techniques of unsharp masking, adaptive histogram equalization, and a plurality of variants on these generic methods, that all suffer to some extent from artifacts created in a vicinity of significant signal level transitions. Further, Toth describes an algorithm for evaluating a ratio of images of two objects, for extracting a region of interest by multiplying the ratio by a function II(r), and for obtaining a calibration error vector by subtracting 1.0 from the ratio and multiplying by a CT number scale factor and an apodizing window. Florent describes a means of an image processing method that includes a determination of a common view point for a source image and a target image, and of an orthonormal reference frame having a view point as an origin, and a measurement of a tilting angle, a panning angle, and a scale factor of the target image in the reference frame. Accordingly, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests estimating a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s.

For at least the reasons set forth above, Claim 4 is submitted to be patentable over Mattson in view of Snyder, Labaere and Toth, and further in view of Florent.

Claims 5, 7, 8, and 10-12 depend, directly or indirectly, from independent Claim 4. When the recitations of Claims 5, 7, 8, and 10-12 are considered in combination with the recitations of Claim 4, Applicant submits that dependent Claims 5, 7, 8, and 10-12 likewise are patentable over Mattson in view of Snyder, Labaere and Toth, and further in view of Florent.

Claim 16 recites a computer programmed to "estimate a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s; generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in z; generate an error-candidate projection using the gradient image; and forward project the gradient image along β wherein β represents a projection view angle."

None of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a computer programmed as recited in Claim 16. Specifically, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a computer programmed to estimate a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s. Rather, Mattson describes removing bad data from an image by thresholding a back projected data set, forward projecting the data set, and then comparing the forward-projected data set to a standard to determine if the data set includes bad data. Snyder describes a gradient estimation system that includes a threshold segmentation system that processes the gradient image to generate a plurality of mask images that are used to generate a plurality of signal dependent noise estimates. Labaere describes commonly known techniques of unsharp masking, adaptive histogram equalization, and a plurality of variants on these generic methods, that all suffer to some extent from artifacts created in a vicinity of significant signal level transitions. Further, Toth describes an algorithm for evaluating a ratio of images of two objects, for extracting a region of interest by multiplying the ratio by a function II(r), and for obtaining a calibration error vector by subtracting 1.0 from the ratio and multiplying by a CT number scale factor and an apodizing window. Florent describes a means of an image processing method that includes a determination of a common view point for a source image and a target image, and of an orthonormal reference frame having a view point as an origin, and a measurement of a tilting angle, a

panning angle, and a scale factor of the target image in the reference frame. Accordingly, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests estimating a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s.

For at least the reasons set forth above, Claim 16 is submitted to be patentable over Mattson in view of Snyder, Labaere and Toth, and further in view of Florent.

Claims 17, 20, and 21 depend from independent Claim 16. When the recitations of Claims 17, 20, and 21 are considered in combination with the recitations of Claim 16, Applicant submits that dependent Claims 17, 20, and 21 likewise are patentable over Mattson in view of Snyder, Labaere and Toth, and further in view of Florent.

Claim 25 recites a computed tomographic (CT) imaging system for reconstructing an image of an object, the imaging system including "a detector array; at least one radiation source; and a computer coupled to said detector array and said radiation source, said computer configured to: estimate a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s; generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*; and generate an error-candidate projection using the gradient image."

None of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a computed tomographic imaging system for reconstructing an image of an object as recited in Claim 25. Specifically, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a computed tomographic imaging system that includes a computer configured to estimate a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s. Rather, Mattson describes removing bad data from an image by thresholding a back projected data set, forward projecting the data set, and then comparing the forward-projected data set to a standard to determine if the data set includes bad data. Snyder describes a gradient estimation system that includes a threshold segmentation system that processes the gradient image to generate a plurality of mask images that are used to generate a

plurality of signal dependent noise estimates. Labaere describes commonly known techniques of unsharp masking, adaptive histogram equalization, and a plurality of variants on these generic methods, that all suffer to some extent from artifacts created in a vicinity of significant signal level transitions. Further, Toth describes an algorithm for evaluating a ratio of images of two objects, for extracting a region of interest by multiplying the ratio by a function II(r), and for obtaining a calibration error vector by subtracting 1.0 from the ratio and multiplying by a CT number scale factor and an apodizing window. Florent describes a means of an image processing method that includes a determination of a common view point for a source image and a target image, and of an orthonormal reference frame having a view point as an origin, and a measurement of a tilting angle, a panning angle, and a scale factor of the target image in the reference frame. Accordingly, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests estimating a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s.

For at least the reasons set forth above, Claim 25 is submitted to be patentable over Mattson in view of Snyder, Labaere and Toth, and further in view of Florent.

In addition, Applicant respectfully submits that the Section 103 rejection of Claims 4, 5, 7, 8, 10-12, 16, 17, 20, 21, and 25 is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. None of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests the claimed invention. Further, in contrast to the Examiner's assertion within the Office Action, Applicant respectfully submits that it would not be obvious to one skilled in the art to combine Mattson with Snyder, Labaere, Toth, or Florent, because there is no motivation to combine the references suggested in the cited art itself.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicant's disclosure, in the prior

art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck, 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion nor motivation to combine the prior art disclosures, or any reasonable expectation of success has been shown.

Further, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. It is also impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection is based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention. Specifically, Mattson describes removing bad data from an image by thresholding a back projected data set, forward projecting the data set, and then comparing the forward-projected data set to a standard to determine if the data set includes bad data. Snyder describes a gradient estimation system that includes a threshold segmentation system that processes the gradient image to generate a plurality of mask images that are used to generate a plurality of signal dependent noise estimates. Labaere describes commonly known techniques of unsharp masking, adaptive histogram equalization, and a plurality of variants on these generic methods, that all suffer to some extent from artifacts created in a vicinity of significant signal level transitions. Moreover, Toth describes an algorithm for evaluating a ratio of images of two objects, for extracting a region of interest by multiplying the ratio by a function II(r), and for obtaining a calibration error vector by subtracting 1.0 from the ratio and multiplying by a CT number scale factor and an apodizing window. Florent describes a means of an image processing method that includes a determination of a common view point for a source image and a target image, and of an orthonormal reference frame having a view point as an origin, and a measurement of a tilting angle, a panning angle, and a scale factor of the target image in the reference frame. Since there is no teaching or suggestion in the cited art for the combination, the Section 103 rejection appears to be based on a hindsight reconstruction in which

isolated disclosures have been picked and chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicant requests that the Section 103 rejection of Claims 4, 5, 7, 8, 10-12, 16, 17, 20, 21, and 25 be withdrawn.

For at least the reasons set forth above, Applicant respectfully requests that the Section 103 rejection of Claims 4, 5, 7, 8, 10-12, 16, 17, 20, 21, and 25 be withdrawn.

The rejection of Claims 9 and 19 under 35 U.S.C. § 103(a) as being unpatentable over Mattson in view of Snyder, Labaere, Toth, Florent, and further in view of Moore (U.S. Patent 4,222,104) ("Moore") is respectfully traversed.

Mattson, Snyder, Labaere, Toth, and Florent are described above. Moore describes a computed tomography system and method. The computed tomography system provides data signals for sets of radiation paths. All of the paths of a set are parallel to each other. In the computed tomography method, a plurality of modified and interpolated path signals are back projected along a plurality of parallel paths into a matrix of points of an object. For a second pass, the modified and interpolated signals are forward projected along parallel paths, corrected and once more back projected along the parallel paths.

Claim 9 depends from independent Claim 4, which recites a method for facilitating reconstruction of an image, the method including "estimating a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s; generating a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in z; and generating an error-candidate projection using the gradient image, wherein to generate the error-candidate projection, said method further comprises forward projecting the gradient image along β wherein β represents a projection view angle."

None of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests a method for facilitating reconstruction of an image as recited in Claim 4. Specifically, none of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests a method that includes estimating a gradient for at least one high-density object using a

plurality of reconstructed images separated by a spacing s. Rather, Mattson describes removing bad data from an image by thresholding a back projected data set, forward projecting the data set, and then comparing the forward-projected data set to a standard to determine if the data set includes bad data. Snyder describes a gradient estimation system that includes a threshold segmentation system that processes the gradient image to generate a plurality of mask images that are used to generate a plurality of signal dependent noise estimates. Labaere describes commonly known techniques of unsharp masking, adaptive histogram equalization, and a plurality of variants on these generic methods, that all suffer to some extent from artifacts created in a vicinity of significant signal level transitions. Further, Toth describes an algorithm for evaluating a ratio of images of two objects, for extracting a region of interest by multiplying the ratio by a function II(r), and for obtaining a calibration error vector by subtracting 1.0 from the ratio and multiplying by a CT number scale factor and an apodizing window. Florent describes a means of an image processing method that includes a determination of a common view point for a source image and a target image, and of an orthonormal reference frame having a view point as an origin, and a measurement of a tilting angle, a panning angle, and a scale factor of the target image in the reference frame. Moore describes forward projection and backprojection of radiation paths. Accordingly, none of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests estimating a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s.

For at least the reasons set forth above, Claim 4 is submitted to be patentable over Mattson in view of Snyder, Labaere, Toth, and Florent, and further in view of Moore.

When the recitations of Claim 9 are considered in combination with the recitations of Claim 4, Applicant submits that dependent Claim 9 likewise is patentable over Mattson in view of Snyder, Labaere, Toth, Florent, and further in view of Moore.

Claim 19 depends indirectly from Claim 16 which recites a computer programmed to "estimate a gradient for at least one high-density object using a

plurality of reconstructed images separated by a spacing s; generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in *z*; generate an error-candidate projection using the gradient image; and forward project the gradient image along β wherein β represents a projection view angle."

None of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests a computer programmed as recited in Claim 16. Specifically, none of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests a computer programmed to estimate a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s. Rather, Mattson describes removing bad data from an image by thresholding a back projected data set, forward projecting the data set, and then comparing the forward-projected data set to a standard to determine if the data set includes bad data. Snyder describes a gradient estimation system that includes a threshold segmentation system that processes the gradient image to generate a plurality of mask images that are used to generate a plurality of signal dependent noise estimates. Labaere describes commonly known techniques of unsharp masking, adaptive histogram equalization, and a plurality of variants on these generic methods, that all suffer to some extent from artifacts created in a vicinity of significant signal level transitions. Further, Toth describes an algorithm for evaluating a ratio of images of two objects, for extracting a region of interest by multiplying the ratio by a function $\Pi(r)$, and for obtaining a calibration error vector by subtracting 1.0 from the ratio and multiplying by a CT number scale factor and an apodizing window. Florent describes a means of an image processing method that includes a determination of a common view point for a source image and a target image, and of an orthonormal reference frame having a view point as an origin, and a measurement of a tilting angle, a panning angle, and a scale factor of the target image in the reference frame. Moore describes forward projection and backprojection of radiation paths. Accordingly, none of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests estimating a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s.

For at least the reasons set forth above, Claim 16 is submitted to be patentable over Mattson in view of Snyder, Labaere Toth, and Florent, and further in view of Moore.

When the recitations of Claim 19 are considered in combination with the recitations of Claim 16, Applicant submits that dependent Claim 19 likewise is patentable over Mattson in view of Snyder, Labaere, Toth, Florent, and further in view of Moore.

In addition, Applicant respectfully submits that the Section 103 rejection of Claims 9 and 19 is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. None of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests the claimed invention. Further, in contrast to the Examiner's assertion within the Office Action, Applicant respectfully submits that it would not be obvious to one skilled in the art to combine Mattson with Snyder, Labaere, Toth, Florent, or Moore, because there is no motivation to combine the references suggested in the cited art itself.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicant's disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicant's disclosure. In re Vaeck, 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion nor motivation to combine the prior art disclosures, or any reasonable expectation of success has been shown.

Further, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. It is also impermissible to pick and choose from any one

reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection is based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention. Specifically, Mattson describes removing bad data from an image by thresholding a back projected data set, forward projecting the data set, and then comparing the forward-projected data set to a standard to determine if the data set includes bad data. Snyder describes a gradient estimation system that includes a threshold segmentation system that processes the gradient image to generate a plurality of mask images that are used to generate a plurality of signal dependent noise estimates. Labaere describes commonly known techniques of unsharp masking, adaptive histogram equalization, and a plurality of variants on these generic methods, that all suffer to some extent from artifacts created in a vicinity of significant signal level transitions. Moreover, Toth describes an algorithm for evaluating a ratio of images of two objects, for extracting a region of interest by multiplying the ratio by a function $\Pi(r)$, and for obtaining a calibration error vector by subtracting 1.0 from the ratio and multiplying by a CT number scale factor and an apodizing window. Florent describes a means of an image processing method that includes a determination of a common view point for a source image and a target image, and of an orthonormal reference frame having a view point as an origin, and a measurement of a tilting angle, a panning angle, and a scale factor of the target image in the reference frame. Moore describes forward projection and backprojection of radiation paths. Since there is no teaching or suggestion in the cited art for the combination, the Section 103 rejection appears to be based on a hindsight reconstruction in which isolated disclosures have been picked and chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicant requests that the Section 103 rejection of Claims 9 and 19 be withdrawn.

For at least the reasons set forth above, Applicant respectfully requests that the Section 103 rejection of Claims 9 and 19 be withdrawn.

The Advisory Action on page 1 asserts that "[t]he request for reconsideration has been considered but does NOT place the application in condition for allowance..." Applicant respectfully submits that a request for reconsideration was

not submitted in response to the Final Office Action. Rather, an Amendment After Final was mailed March 12, 2007 in response to the Final Office Action. Further, the Advisory Action on page 2 asserts that the "[a]rguments are not persuasive and were addressed in the previous Office action (dated 12 December 2006)." Applicant respectfully traverses this assertion and submits that the arguments pertaining to the amended claims were not addressed in the Final Office Action dated December 12, 2006 because the amendment and remarks were made in response to the Final Office Action and have not subsequently been entered.

In view of the foregoing amendment and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully submitted,

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